WHAT IS CLAIMED IS:

1. A process for making a pot comprising:

(a) cutting an ingot comprising a refractory metal component into a first work piece;

(b) subjecting the first work piece to upset forging, and thereby forming a second work piece;

(c) subjecting the second work piece to a first annealing step in a vacuum or an inert gas to a first temperature that is sufficiently high to cause at least partial recrystallization of the second work piece, and thereby forming an annealed second work piece;

(d) forging-back the annealed second work piece by reducing the diameter of the second work piece, and thereby forming a third work piece;

(e) subjecting the third work piece to upset forging, and thereby forming a fourth work piece;

(f) forging back the fourth work piece by reducing the diameter of the fourth work piece, and thereby forming a fifth work piece;

(g) subjecting the fifth work piece to a second annealing step to a temperature that is sufficiently high to at least partially recrystallize the fifth work piece;

(h) subjecting the fifth work piece to upset forging, and thereby forming a sixth work piece;

(i) subjecting the sixth work piece to a third annealing step, and thereby forming an annealed sixth work piece;

(j) rolling the annealed sixth work piece into a plate by subjecting the annealed sixth work piece to a plurality of rolling passes; wherein the annealed sixth work piece undergoes a reduction in thickness after at least one pass and the annealed sixth work piece is turned between at least one pass, and thereby forming a plate; and

(k) deep drawing the plate into a pot, thereby forming the pot; wherein a fourth annealing step is carried out either (1) after step (j) before step (k), or (2) after step (k),

wherein dimensions of at least one work piece or plate suitable for processing into a pot are pre-determined with a computer-implemented finite element modeling assessment method so that at least one work piece in steps (b)-(j) or plate in step (k) has dimensions that are substantially similar to the dimensions determined by the computer-implemented finite element modeling assessment method.

2. The process of Claim 1, wherein the first temperature is at least about 1200 °C.

3. The process of Claim 1, wherein the refractory metal component is selected from the group consisting of (a) niobium, (b) tantalum, (c) niobium alloys, (f) tantalum alloys, and combinations thereof.

4. The process of Claim 1, wherein the ingot is a tantalum ingot having a purity that is at least 99.99%.

5. The process of Claim 1, wherein the ingot is a tantalum ingot having a purity that is at least 99.999%.

6. The process of Claim 1, wherein the ingot is a tantalum ingot having a purity that is at least 99.9999%.

7. The process of Claim 1, wherein the upset forging step (h) is carried out between flat dies with a press.

8. The process of Claim 1, wherein the upset forging step (h) is carried out in a first stage and a second stage, wherein the first stage is carried out with flat dies and the second stage is carried out with a plurality of blows, using sheetbar dies, wherein the work piece is turned by a suitable angle between blows.

9. The process of Claim 1, wherein the first annealing step temperature is more than about 1300 C.

10. The process of Claim 1, wherein the pot has a uniform grain size, wherein the average grain size of any microscope field is within 0.5 ASTM points of the overall average grain size.

11. The process of Claim 1, wherein the pot has a uniform grain size, wherein the average grain size of any microscope field is within 1 ASTM points of the overall average grain size.

12. The process of Claim 1, wherein the average grain size ranges from about ASTM 4 to about ASTM 6, as defined in ASTM Standard E112.

13. The process of Claim 1, wherein the ingot is cylindrical and it has a diameter ranging from 150 mm to 400 mm.

14. The process of Claim 1, wherein the first work piece has a diameter equal to that of the ingot, and a length-to-diameter ratio ranging from about 1.5:1 to about 3:1.

15. The process of Claim 1, wherein the second work piece has a length ranging from about 50% of its original length to about 70 % of its original length.

16. The process of Claim 1, wherein the third work piece has a diameter ranging from about 60% of the diameter of the first work piece to about 120% of the diameter of the first work piece.

17. The process of Claim 1, wherein the fourth work piece has a length ranging from about 80% of the length of the second work piece to about 120% of the length of the second work piece.

18. The process of Claim 1, wherein the fifth work piece has a diameter ranging from about 60% of the diameter of the first work piece to about 120% of the diameter of the first work piece.

19. The process of Claim 1, wherein the sixth work piece has a length-to-diameter ratio ranging from about 1:2 to about 1:5.

20. The process of Claim 1, wherein the plate has a diameter ranging from about 500 mm to about 1 m, and a thickness ranging from about 6 mm to about 15 mm.

21. The process of Claim 1, wherein the pot has a height ranging from about 150 mm to about 500 mm and a diameter ranging from about 100 mm to about 500 mm.

22. The process of Claim 1, wherein the first work piece is subjected to a true strain that is from about 0.25 to 0.5 before the first annealing step and the first annealing step is carried out at a temperature that is at least about 1300 C.

23. The process of Claim 1, wherein the second work piece is subjected to a strain that is greater than about 1 and less than about 2 in steps (d), (e) and (f) before the fifth being subjected to the second annealing step.

24. The process of Claim 1, wherein the sixth work piece is subjected to a true strain that is greater than about 1 and less than about 2 before being subjected to the third annealing step.

25. The process of Claim 1, wherein the plate or the pot is subjected to a strain that is greater than about 1 before being subjected to the fourth annealing step.

26. The process of Claim 1, wherein the process further comprises the steps of pre-determining types and sizes of imperfections which could render at least one work piece or plate unsuitable for processing into a pot with a computer-implemented finite element modeling assessment method; wherein at least one work piece in steps (b)-(j) or plate in step (k) does not have at least one imperfection determined to be detrimental by the computer-implemented finite element modeling assessment method.

27. The pot made in accordance to the process of Claim 1.

28. A sputtering target comprising:

(a) a pot having a refractory metal component; and

(b) a collar attached to the pot; , wherein the pot is made by a process comprising:

(a) cutting an ingot comprising a refractory metal component into a first work piece;

(b) subjecting the first work piece to upset forging, and thereby forming a second work piece;

(c) subjecting the second work piece to a first annealing step in a vacuum or an inert gas to a first temperature that is sufficiently high to cause at least partial recrystallization of the second work piece, and thereby forming an annealed second work piece;

(d) forging-back the annealed second work piece by reducing the diameter of the second work piece, and thereby forming a third work piece;

(e) subjecting the third work piece to upset forging, and thereby forming a fourth work piece;

(f) forging back the fourth work piece by reducing the diameter of the fourth work piece, and thereby forming a fifth work piece;

(g) subjecting the fifth work piece to a second annealing step to a temperature that is sufficiently high to at least partially recrystallize the fifth work piece;

(h) subjecting the fifth work piece to upset forging, and thereby forming a sixth work piece;

(i) subjecting the sixth work piece to a third annealing step, and thereby forming an annealed sixth work piece;

(j) rolling the annealed sixth work piece into a plate by subjecting the annealed sixth work piece to a plurality of rolling passes; wherein the annealed sixth work piece undergoes a reduction in thickness after at least one pass and the annealed sixth work piece is turned between at least one pass, and thereby forming a plate; and

(k) deep drawing the plate into a pot, thereby forming the pot;
wherein a fourth annealing step is carried out either (1) after step (j) before step (k), or (2) after step (k),

wherein dimensions of at least one work piece or plate suitable for processing into a pot are pre-determined with a computer-implemented finite element modeling assessment method so that at least one work piece in steps (b)-(j) or plate in step (k) has dimensions that are substantially similar to the dimensions determined by the computer-implemented finite element modeling assessment method.

29. The sputtering target of Claim 28, wherein the collar is welded to the pot.

30. The sputtering target of Claim 28, wherein the collar is made from a refractory metal component or a metal that can be welded to the pot material in such a way as to give a joint free from cracks.

31. The sputtering target of Claim 28, wherein the collar is made from a refractory metal component is selected from the group consisting of (a) niobium, (b) tantalum, (c) niobium alloys, (f) tantalum alloys, and combinations thereof.

32. A process comprising pre-determining imperfections of at least one work piece or plate unsuitable for processing into a pot with a computer-implemented finite element modeling assessment method.

33. A process comprising pre-determining dimensions of at least one work piece or plate suitable for processing into a pot with a computer-implemented finite element modeling assessment method.

34. A process for making a plate comprising:

(a) cutting an ingot comprising a refractory metal component into a first work piece;

(b) subjecting the first work piece to upset forging, and thereby forming a second work piece;

(c) subjecting the second work piece to a first annealing step in a vacuum or an inert gas to a first temperature that is sufficiently high to cause at least partial recrystallization of the second work piece, and thereby forming an annealed second work piece;

(d) forging-back the annealed second work piece by reducing the diameter of the second work piece, and thereby forming a third work piece;

(e) subjecting the third work piece to upset forging, and thereby forming a fourth work piece;

(f) forging back the fourth work piece by reducing the diameter of the fourth work piece, and thereby forming a fifth work piece;

(g) subjecting the fifth work piece to a second annealing step to a temperature that is sufficiently high to at least partially recrystallize the fifth work piece;

(h) subjecting the fifth work piece to upset forging, and thereby forming a sixth work piece;

(i) subjecting the sixth work piece to a third annealing step, and thereby forming an annealed sixth work piece;

(j) rolling the annealed sixth work piece into a plate by subjecting the annealed sixth work piece to a plurality of rolling passes; wherein the annealed sixth work piece undergoes a reduction in thickness after at least one pass and the annealed sixth work piece is turned between at least one pass, and thereby forming a plate

35. The plate made in accordance to the process of Claim 34.

36. The process of Claim 34, wherein the development of the process further comprises the step of pre-determining the dimensions of the inside surface of the die used for deep-drawing, such that the work piece is trapped between punch and die and its dimensions thus controlled precisely.